Amendments to Specification

Page 6; rewrite the paragraph starting at line 8, to read as follows:

Similarly, in case of the multilayer optical disc, the spherical aberration have a greater differences (error ΔSA) as the objective lens of the optical pickup apparatus has a larger NA, even if the layer-to-layer distance t between the adjacent information recording layers is constant. For example, when NA = 0.85, a approximately four-time larger difference is generated between the spherical aberration SA, compared with the case where NA = 0.6. Therefore, according to the equation (1), it is indicated that the difference between the respective spherical aberration between the respective information layers ~~bets~~ gets greater as the NA becomes higher, for example, when NA = 8.5.

Pages 6-7; rewrite the paragraph starting at line 21 on page 6, to read as follows:

Thus, it is a problem for an objective lens having a high NA, which is inevitably affected by the error of the spherical aberration, that the information is read in a low accuracy. Thus, it is necessary to compensate for the spherical aberration in order to realize the high recording density by using the objective lens of the high NA.

Pages 10-11; rewrite the paragraph starting at line 25 on page 10, to read as follows:

Because this makes it possible to optically detect the focal point dislocation of the converging optical system without the offset, it is possible to appropriately compensate for the focal point dislocation of the converging optical system. As a result, it is possible to accurately

focus to have the focal point of the converging optical system of the information recording layer of the optical recording medium.

Pages 11-12; rewrite the paragraphs starting at line 8 on page 11 and ending at line 13 on page 12, to read as follows:

Moreover, another focal point dislocation detection method of the present invention includes the step of detecting focal point dislocation of a converging optical system in accordance with a light beam of a 60% to 85% region of a light beam effective diameter, where the light beam effective diameter, which is centered with respect to an optical axis of the light beam passing through the converging optical system including an objective lens, is regulated by ~~a numerical aperture~~ an aperture diameter of the objective lens.

Here, an optimum image point of the light beam, which passes through the converging optical system, approximately matches with a converging point (focal point) at which the light beam of the 60% to 85% region of the light beam effective diameter, which is centered with respect to an optical axis of the light beam passing through the converging optical system including an objective lens, is regulated by ~~a numerical aperture~~ an aperture diameter of the objective lens.

Therefore, even if the spherical aberration is generated, it is possible to accurately detect the focal point dislocation without being significantly affect by the spherical aberration, with the above arrangement where the focal point dislocation of a converging optical system is detected in accordance with a light beam of a 60% to 85% region of a light beam effective diameter, where

the light beam effective diameter, which is centered with respect to an optical axis of the light beam passing through the converging optical system including an objective lens, is regulated by ~~a numerical aperture~~ an aperture diameter of the objective lens.

Page 27; rewrite the paragraph starting at line 14 (*i.e.*, the line that follows equation (5)), to read as follows:

where 13aS and 13bS are the electric signals from the detectors 13a and 13b that convert the diffracted light from the third region 2c of the hologram 2 into the electric signals. Here, in the case the focal point is not located on the information layer, output values of the respective focus error signals F1, F2 and F3 represent an amount of the focal point dislocation.

Page 29; rewrite the paragraph starting at line 19, to read as follows:

On the other hand, when the spherical aberration is generated in the light beam, as shown in Figure 5b, a focal point A is located in a position beyond the best image point O on the optical axis ~~OX~~ OZ with respect to the lens outer peripheral section, while a focal point B is located in a position closer than the optimum image point O with respect to the lens inner peripheral section, which is closer to the optical axis OZ.

Pages 31-32; rewrite the paragraph starting at line 13 on page 31, to read as follows:

More specifically, as shown in Figure 7, the focal point of the ideal wavefront 16 having no spherical aberration is in the position that is matched with the position of the focal point of

extreme values of the regions 18a and 18b, which are boundary of the wavefront 17 having the spherical aberration. Therefore, the position of the focal point is detected in accordance with the light beam that corresponds to the regions 18a and 18b, which are regions ~~region~~ of the extreme value of the wavefront 17 having the spherical aberration or in a vicinity of the extreme value. In this way, it is possible to detect the focal point dislocation without being significantly affected by the spherical aberration, because dislocation of the focal point position (the optimum image point O) of the optical pickup apparatus 10 is coincident with dislocation of the focal point position of the extreme value.

Page 33; rewrite the paragraph starting at line 8, to read as follows:

In Figure 8, there are illustrated are results of calculations of (a) an amount of the offset of the focus error signal when the focal point dislocation is detected by using a ~~60% to 80%~~ 60% to 85% region of the light beam effective diameter in case the spherical aberration is generated as a result of the change in the thickness of the cover glass 6a of the optical disc 6, and (b) an amount of the offset of the focus error signal detected by using the whole region of the light beam effective diameter, as the equation (6).

Page 33; rewrite the paragraph starting at line 18, to read as follows:

Here, the optimum image point is inclined to the focal point position of a light beam outer periphery as an amount of the spherical aberration is increased. Thus, a region having more or equal to 70% of the light beam effective diameter has ~~of~~ a larger share in a region set in the

calculations, compared with a region having less or equal to 70% of the light beam effective diameter.

Pages 46-48; rewrite the paragraphs starting at line 1 on page 46 and ending at line 4 on page 48, to read as follows:

Moreover, another focal point dislocation detection method of the present invention includes the step of detecting focal point dislocation of a converging optical system in accordance with a light beam of a 60% to 85% region of a light beam effective diameter, where the light beam effective diameter, which is centered with respect to an optical axis of the light beam passing through the converging optical system including an objective lens, is regulated by ~~a numerical aperture~~ an aperture diameter of the objective lens.

This arrangement approximately matches (a) the optimum image point of the light beam that has passed through the converging optical system with (b) the convergent point (focal point) of the light beam of the 60% to 85% region of the light beam effective diameter, where the light beam effective diameter, which is centered with respect to the optical axis of the light beam passing through the converging optical system including the objective lens, is regulated by the ~~numerical~~ aperture diameter of the objective lens.

Therefore, even if the spherical aberration is generated in the converging optical system, it is possible to accurately detect the focal point dislocation without being significantly affected by the spherical aberration, when, as the above arrangement, the detection of the focal point dislocation of the converging optical system is performed in accordance with the light beam of

the 60% to 85% region of the light beam effective diameter, where the light beam effective diameter, which is centered with respect to the optical axis of the light beam passing through the converging optical system including the objective lens, is regulated by the ~~numerical~~ aperture diameter of the objective lens.

Because this realizes the optical detection of the focal point dislocation of the converging optical system, the focal point dislocation of the converging optical system can be appropriately compensated, thereby accurately forming the focus point of the converging optical system on the information recording layer of the optical recording medium.

The focal point dislocation detection method of the present invention may be so arranged to include the step of detecting the focal point dislocation of the converging optical system in accordance with a first focus error signal, which indicates the focal point dislocation of the converging optical system, where the first focus error signal is generated by (1) separating, out of the light beams passing through the converging optical system, the light beam of the 60% to 85% region of the light beam effective diameter that is regulated by the ~~numerical~~ aperture diameter of the objective lens, and (2) converting the separated light beam electrically.

Pages 48-50; rewrite the paragraphs starting at line 19 on page 48 and ending at line 25 on page 50, to read as follows:

The focal point dislocation detection method of the present invention may be so arranged that the separated light beam is obtained by passing a light beam, which has passed the converging optical system, through a light separating region, which is surrounded by a first circle

or circular arc and a second circle or circular arc, where the first circle has a diameter larger than a diameter equivalent with 85% of the light beam effective diameter that is regulated by the ~~numerical~~ aperture diameter and is centered with respect to the optical axis of the light beam passing through the converging optical system, and where the second circle or circular arc has a diameter smaller than a diameter equivalent with 60% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens.

In this case, the light beam necessary for the detection of the focal point dislocation of the converging optical system can be easily obtained by using the light separating region surrounded by the first circle or circular arc and the second circle or circular arc, where the first circle has the diameter larger than the diameter equivalent with 85% of the light beam effective diameter that is regulated by the ~~numerical~~ aperture diameter and is centered with respect to the optical axis of the light beam passing through the converging optical system, and where the second circle or circular arc has the diameter smaller than the diameter equivalent with 60% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens.

The focal point dislocation detection method of the present invention may be so arranged to include the step of detecting spherical aberration of the converting optical system in accordance with at least one of a second focus error signal and a third focus error signal, where the second focus error signal is obtained by detecting focal point dislocation of a light beam that passes a region inside the second circle or circular arc, and where the third focus error signal is obtained by detecting focal point dislocation of a light beam that passes a region outside the first circle or circular arc.

In this case, as discussed above, without being affected by the spherical aberration, the optimum image point is matched by the light beam, which passes the region surrounded by the first circle or circular arc and the second circle or circular arc, where the first circle has the diameter larger than the diameter equivalent with 85% of the light beam effective diameter that is regulated by the ~~numerical~~ aperture diameter and is centered with respect to the optical axis of the light beam passing through the converging optical system, and where the second circle or circular arc has the diameter smaller than the diameter equivalent with 60% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens.

Pages 54-59; rewrite the paragraphs starting at line 11 on page 54 and ending at line 15 on page 59, to read as follows:

Another optical pickup apparatus of the present invention is provided with (a) a light source, (b) a converging optical system, including an objective lens for converging a light beam emitted from the light source onto an optical recording medium, and (c) focal point dislocation detecting means for detecting focal point dislocation of the converging optical system in accordance with a light beam of a 60% to 85% region of a light beam effective diameter, where the light beam effective diameter, which is centered with respect to an optical axis of the light beam passing through the converging optical system, is regulated by ~~a numerical aperture~~ an aperture diameter of the objective lens.

Here, the optimum image point of the light beam, which has passed the converging optical system, approximately matches with the convergent point (focal point) at which the light

beam of the 60% to 85% region of the light beam effective diameter, which is centered with respect to the optical axis of the light beam passing the converging optical system including the object lens, and which is regulated by the ~~numerical~~ aperture diameter of the objective lens.

Therefore, even if the spherical aberration is generated in the converging optical system, it is possible to optically detect the focal point dislocation of the converging optical system without the offset, by performing the detection of the focal point dislocation of the converging optical system in accordance with the light beam of the 60% to 85% region of the light beam effective diameter, where the light beam effective diameter, which is centered with respect to the optical axis of the light beam passing through the converging optical system, is regulated by the ~~numerical~~ aperture diameter of the objective lens.

Because this makes it possible to appropriately compensate the focal point dislocation of the converging optical system without being affected by the spherical aberration, the focal point of the converging optical system is accurately located on the information recording layer of the optical recording medium. As a result, the excellent recording/reproduction of information to/from the optical recording medium may be performed all the time.

The focal point dislocation detecting means may include (a) light beam separating means for separating, out of light beams passing the converging optical system, the light beam of the 60% to 85% region of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens, and (b) first signal generation means for generating a first focus error signal in accordance with the light beam separated by the light beam separating means,

wherein the first focus error signal indicates focus point dislocation of the converging optical system.

In this case, the focal point dislocation of the converging optical system can be detected by using the electric signal, with the above arrangement where the first focus error signal, which indicates the focal point dislocation, is generated by electrically converting the light beam that is separated from the light beams that have passed the converging optical system.

Because the thus obtained electric signal can be used in the driving circuit for driving and controlling the converging optical system, the focal point dislocation can be easily compensated by driving the converging optical system to an appropriate position.

It may be so arranged that the light beam separating means includes a first light separating region, which is surrounded by a first circle or circular arc and a second circle or circular arc, where the first circle has a diameter larger than a diameter equivalent with 85% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens, and is centered with respect to the optical axis of the light beam passing through the converging optical system, and where the second circle or circular arc has a diameter smaller than a diameter equivalent with 60% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens, wherein the first signal generating means generates the first focus error signal in accordance with a light beam that passes through the first light separating region of the light beam separating means.

In this case, the light beam necessary for the detection of the focal point dislocation of the converging optical system can be easily separated by using the light beam separating means that

includes the first light separating region, which is surrounded by the first circle or circular arc and the second circle or circular arc, where the first circle has the diameter larger than the diameter equivalent with 85% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens, and is centered with respect to the optical axis of the light beam passing through the converging optical system, and where the second circle or circular arc has the diameter smaller than the diameter equivalent with 60% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens.

Furthermore, the optical pickup apparatus of the present invention may be provided with (a) second signal generating means for generating a second focus error signal by detecting focal point dislocation of a light beam passing through a region inside the second circle or circular arc of the light beam separating means, (b) third signal generating means for generating a third focus error signal by detecting focal point dislocation of a light beam passing through a region outside the first circle or circular arc, (c) spherical aberration detecting means for detecting spherical aberration of the converging optical system in accordance with at least one of the second and third focus error signals.

In this case, as discussed above, the spherical aberration does not affect the matching between (a) the optimum image point and (b) the light beam that passes through the region surrounded by the first circle or circular arc and the second circle or circular arc, where the first circle has the diameter larger than the diameter equivalent with 85% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens, and is centered with respect to the optical axis of the light beam passing through the converging optical system, and

where the second circle or circular arc has the diameter smaller than the diameter equivalent with 60% of the light beam effective diameter regulated by the ~~numerical~~ aperture diameter of the objective lens.